

## **II. AMENDMENTS TO THE CLAIMS.**

Please replace the existing set of claims with the following set in which Claims 2, 9, 15 and 18 have been cancelled, without prejudice and Claims 1, 3, 8, 14 and 17 have been amended.

1. (Currently Amended) A waveguide optical mode transformer, comprising:  
a core formed of a single material on a planar substrate structure, said core having first and second ends, a top surface and a flat, planar bottom surface adjacent the planar substrate structure; and  
a predetermined plurality of steps formed into the top surface of the core so as to vertically taper the core between the first and second ends, each step having a predetermined height and a predetermined length, ~~said core further including a plurality of steps formed on the side surfaces of said core so as to horizontally taper said core, and said steps being dry etched upon said core~~ having side surfaces and the side surfaces being smooth from the first end of the core to the second end of the core to create a uniform, horizontal taper.
2. Cancelled.
3. (Previously presented) The waveguide optical mode transformer of claim 1, wherein the vertical and horizontal tapers narrow at the same end of the core.
4. (Original) The waveguide optical mode transformer of claim 1, further comprising a dielectric cladding layer formed over the core.
5. (Original) The waveguide optical mode transformer of claim 1, wherein the planar substrate structure includes a dielectric layer formed over a semiconductor substrate.
6. (Original) The waveguide optical mode transformer of claim 1, wherein the core is crystalline silicon.

7. (Original) The waveguide optical mode transformer of claim 1, further comprising dielectric layers formed under and over the core, wherein the dielectric layers each have a refractive index that is lower than the refractive index of the core.
8. (Currently Amended) An optical system, comprising:
  - a planar waveguide; and
  - a tapered waveguide extension formed at ~~the~~ an end of the planar waveguide for coupling light between the planar waveguide and an optical fiber, the waveguide extension having a core formed of a single material on a planar substrate structure, said core having first and second ends, a top surface, side surfaces and a flat, planar bottom surface opposite said top surface and positioned adjacent said planar substrate structure, a predetermined plurality of steps formed into the top ~~and side surfaces thereof~~ surface by dry etching the waveguide extension so as to vertically ~~and horizontally~~ taper said waveguide extension between the first and second ends, each of the steps having predetermined height, ~~width~~ and length, and the side surfaces being smooth from the first end of the waveguide extension to a second end of the waveguide extension to create a uniform, horizontal taper.
9. Cancelled.
10. (Original) The optical system of claim 8, wherein the tapered waveguide extension includes a crystalline silicon core.
11. (Original) The optical system of claim 10, wherein the tapered waveguide extension includes a dielectric cladding layer formed over the core.
12. (Original) The optical system of claim 8, wherein the tapered waveguide extension includes a core layer between two dielectric layers, wherein the dielectric layers each have a refractive index that is lower than the refractive index of the core.
13. (Original) The optical system of claim 8, further comprising the optical fiber.

14. (Currently Amended) A method of manufacturing a tapered planar waveguide usable as an optical mode transformer between an optical fiber and a planar waveguide, comprising:
- (a) providing a planar substrate material,
  - providing(b) forming a core layer of core material for the tapered waveguide on the planar substrate material, said core layer having first and second ends, a top surface, and a flat, planar bottom surface opposite said top surface; and
  - (c) forming said first and second ends of the core layer so that the first end is wider than the second end;
  - (d) forming sidewalls of said core layer so that they are smooth and extend between said first end and said second end to create a uniform, horizontal taper between said ends;
  - (e) applying a protective layer over a predetermined area of the core layer extending from the first end towards the second end to define a protected area and leaving an unprotected area on said core layer;
  - (f) dry etching the unprotected area of the core layer to a predetermined depth defining a step having a height without etching through said single core material; and
  - (g) repeating steps (e) and (f) a predetermined number of times, each time extending the protected area farther from the first end to define a length of a new step so as to form ~~forming~~ a predetermined plurality number of steps into in the top and side surfaces ~~surface~~ of the core layer by dry etching so as to vertically and horizontally taper said core layer, each step having a predetermined height; and a predetermined length and width.
15. Cancelled.
16. (Currently Amended) The method of claim 14, wherein the step of providing said substrate further includes: providing ~~a starting material comprising a said~~ substrate; with a dielectric layer formed on the substrate, and the core layer of core material being formed on the dielectric layer.
17. (Cancelled)

18. Cancelled.
19. (Original) The method of claim 14, further comprising polishing the wider end of the tapered waveguide.
20. (Original) The method of claim 14, further comprising applying an anti-reflective coating at the wider end of the tapered waveguide.